MOTOR VEHICLE BODY WHOSE UNDERBODY AREA IS ASSOCIATED WITH REINFORCING STRUTS

The invention relates to a motor vehicle, especially a convertible vehicle with struts provided to its underbody according to the main concept of Claim 1.

There is a general problem in motor vehicles that external excitations from vibration that occur during driving, for example, when driving over roadway roughness, for example, potholes or bumps, can trigger undesired vibrations and torsional flexing of the auto body. Driving safety and comfort can be comprised and the vehicle structure stressed on this account. This problem occurs to a particular degree in convertible vehicles with a self-supporting auto body, which, because of the non-rigid roof (which cannot reinforce the auto body when open), have a stability disadvantage compared to closed vehicle structures. In principle, however, this is true in all vehicles.

It is known to provide separate reinforcing struts to the auto body in the underbody area, one strut pair of which extends from external edge areas in the transverse direction of the vehicle in front of the rear wheel wells to an area lying farther inside in the vicinity of a vertical vehicle longitudinal center plane behind the rear wheel wells and can be attached there to a spare-tire well. However, spare tires are increasingly being dispensed with and only a tire sealant carried along instead. It is often desirable, especially in sports cars, to arrange essential parts of an exhaust system in the middle area, in order to be able to provide ancentral exhaust unit, especially a multi-flow unit. However, the previous possibility of strut attachment on the underbody is difficult or even impossible in such vehicles.

The problem underlying the invention is to expand the possibilities of strut attachment to the auto body in a motor vehicle.

The invention solves this problem by a vehicle with the features of Claim 1. Advantageous embodiments of the object of the invention can be seen from the additional Claims 2 through 10.

Due to the fact that at least one retaining bridge extending beneath part of an exhaust system is provided in the underbody area of the vehicle, struts can be attached to it even beneath areas that

are not suitable per se to accommodate attachment devices. A center exhaust system can therefore be provided without interfering with the optimal geometry of the arrangement of the reinforcing struts on this account.

For example, the retaining bridge can extend beneath an end muffler arranged essentially in a middle of the transverse cross-section of the vehicle, so that this can also be arranged without additional expense for redesign at the usual spacing from the exhaust pipe.

If the retaining bridge lies with a vertical spacing of several centimeters beneath the undercut part of the exhaust system, struts attached there can run horizontally and lie directly against the underbody with their front end areas facing away from the retaining bridge.

It is also possible with the retaining bridge that struts are designed to be vibration-selective and a sensing unit to record longitudinal stresses occurring during driving and at least one control element to cause a force that counteracts the longitudinal stress are assigned to them so that active stabilization of the vehicle is possible with respect to the external vibration excitation.

Additional advantages of features of the invention can be seen from the embodiment example of the object of the invention shown in the drawing and described below.

In the drawing:

Figure 1 shows a schematic perspective view of a motor vehicle according to the invention, shown broken down in its vertical longitudinal center plane,

Figure 2 shows a schematic view of the underbody of the vehicle according to Figure 1 with at least two reinforcing struts in the rear area attached to a common retaining bridge,

Figure 3 shows a detailed partial view of the retaining bridge mounted in Figure 2,

Figure 4 shows a detailed view from the bottom of the mounted retaining bridge with struts attached to it, with the exhaust system not shown,

Figure 5 shows a side view of the struts mounted, at one end, on the retaining bridge and, at the other end, on the underbody of the vehicle,

Figure 6 shows a view of the retaining bridge with the struts attached to it from the front.

In the drawn embodiment example according to Figure 2, a pair of reinforcing struts 4, 5 lying symmetrically to a vertical longitudinal center point 3 is provided at least in the rear area of the underbody 2 of vehicle 1 – here a convertible vehicle, which is not essential. In addition, further struts can lie in the front area of the vehicle. The number and symmetric arrangement of the struts 4, 5 shown here is to be understood only as an example, as is their route.

The struts 4, 5 here are each attached with their front end 6, 7 in the travel direction F directly to the underbody 2 of vehicle 1 in its outer transverse edge area. In the present embodiment example, they are detachably screwed to the underbody 2, for which purpose separate abutments, each provided with an internal thread (not shown), are provided above the underbody 2. Riveting or welding can also be considered.

The struts 4, 5 extend in their route from their front end 6, 7 in front of the rear wheel wells 9 to the rear ends 10, 11, which lie behind wheel wells 9 with respect to the travel direction F, on the vertical longitudinal center plane 3. The struts 4, 5 can each be designed with profiles, for example, tubular or box profiles made of metal, or perhaps also fiber-reinforced plastic. In the embodiment example, tubes with an elliptical cross-section are used, which only vibrate slightly. When larger vibrations must be accommodated, the use of flat iron is also possible. The ends 6, 7, 10, 11 can also be pressed together flat in profile struts 4, 5 in order to simplify passage of the attachment devices. The shape of the struts 4, 5 can deviate significantly from the linear struts shown here. Angled and/or flat components can also be considered as struts.

The rear ends 10, 11 of the struts 4, 5 are attached here to a common retaining bridge 12, which is designed to be essentially trapezoidal (Figure 3, Figure 6), with at least one or (as in the case here) two attachment flanges 13 that engage on the sides. Two individual retaining bridges lying one beyond the other for each of the struts 4, 5 (not shown) are also possible. The retaining bridge or each retaining bridge 12 can be formed from an angled flat iron. It includes here an additional reinforcement 14 in the center area 8 to improve stability. The retaining bridge 12 is

attached (here screwed) with the side attachment flanges 13 to essentially horizontal surfaces 14 of the underbody 2. Depending on the design, attachment of a retaining bridge by only one attachment flange 13 is also possible. In the embodiment example, in the view from below (Figure 4), the attachment flange 13 lies behind the middle area 8 of the retaining bridge 12, so that an almost X-shaped overall route (therefore particularly favorable for torsional rigidity of the vehicle 1) is formed by it with the struts 4, 5.

In each case, the retaining bridge 12 extends beneath part of an exhaust system 15, here an end muffler 16, which is arranged in front of two exhaust pipes 17. The end muffler is arranged in a channel 18 extending upward in the underbody 2 and can lie essentially in the transverse center of the vehicle. The retaining bridge 12 can extend with its middle area several centimeters beneath the end muffler 16 and therefore also permit (in relatively high attachment surfaces 14) a horizontal route of the struts 4, 5 from their rear ends 10, 11 to their front ends 6, 7 (Figure 5). Work on parts of the exhaust system 15 can be possible without disassembly of the retaining bridge 12. The struts 4, 5 can be screwed or attached to the retaining bridge 12 in some other way. Screwing permits simple loosening and reattachment of the struts 4, 5 for possible repair and especially replacement requirements, for example, of the end muffler 16 with the exhaust pipe attached to it.

The struts 4, 5 of the auto body can serve not only as ordinary reinforcement components, but also (not shown) as adaptive vibration dampers, i.e., in addition to the passive reinforcement function, they can also permit the vibration behavior of the auto body to be influenced actively.

For this purpose, the struts 4, 5 can be designed in several parts and can both detect a length change of the struts 4, 5, for example, by piezocrystals, and counteract it actively with a short response time. The struts 4, 5 can also be secured together to a support device, which in turn is mounted so as to be movable on retaining bridge 12 and include, for example, a transverse control arm designed as a balance beam that can be pivoted about an at least almost vertical axis with respect to the retaining bridge 12.

The support device can be influenced in its pivoting movement about the vertical axis by a control element, often also referred to as an actuator, which can be connected at one end to the retaining bridge 12 and at the other end to the balance beam of the support device eccentrically

and with a spacing from its axis. The strut ends 10, 11 can then be coupled to the outer ends of the balance beam.

A sensing unit, which detects torsional flexing of the auto body during excitation of an external vibration, for example, when passing over a pothole or bump, since a tensile or compressive force is introduced to at least one of the struts 4, 5 relative to the other one through its end 6, 7 attached to the auto body, serves to drive the actuator and therefore deflect the balance beam from its normal position. The opposite end 10, 11 attempts on this account to carry the balance beam accordingly and deflect it about its axis.

This deflection tendency is recorded by the sensing unit, which contains a pressure-voltage converter, and converted to an electrical signal for the actuator, which counteracts the torque on the support device introduced by the external force. Because of this deflection, the two struts 4, 5 are exposed to compression and tension in counter-phase to each other. Both struts 4, 5 simultaneously reinforce the auto body on this account and cause active damping. The effect of the external excitation is therefore almost extinguished. The control element and the sensing unit have very short response times, so excitation frequencies of a few Hz to a few tens of Hz can be effectively counteracted.

Claims:

1. A motor vehicle (1), especially a convertible vehicle, with a vehicle body in whose underbody area (2) reinforcing struts (4, 5) are provided, **characterized by** at least one retaining bridge (12) arranged indirectly or directly on the underbody (2) and extending beneath part of an exhaust system (15) for attachment of at least one of the struts (4, 5).

2. A motor vehicle (1) according to Claim 1, **characterized in that** the retaining bridge (12) passes beneath an end muffler (16) arranged essentially in the transverse center of the vehicle.

3. A motor vehicle (1) according to one of the Claims 1 or 2, **characterized in that** rear end areas (10, 11) of two struts (4, 5) can be attached to the retaining bridge (12), which extend from there with one component in the direction of travel (F) and are attached at their front ends (6, 7) to the auto body.

4. A motor vehicle (1) according to one of the Claims 1 to 3, **characterized in that** the retaining bridge (12) lies at a vertical spacing several centimeters beneath the undercut part (16) of the exhaust system (15).

5. A motor vehicle (1) according to one of the Claims 1 to 4, **characterized in that** the struts (4, 5) can be attached to the retaining bridge (12) by screw connections.

6. A motor vehicle (1) according to one of the Claims 1 to 5, **characterized in that** the retaining bridge (12) can be attached to the auto body by screw connections.

7. A motor vehicle (1) according to one of the Claims 1 to 6, **characterized in that** the auto body has a channel (18) extending upward in the underbody (2) for the exhaust system (15) and areas (14) of the auto body lying deeper with respect to it on both sides as attachment surfaces for the retaining bridge (12).

8. A motor vehicle (1) according to one of the Claims 1 to 7, **characterized in that** at least one vibration-selective sensing unit to record longitudinal stresses on the struts (4, 5) occurring during driving and at least one control element to cause a force that counteracts the longitudinal stress are provided in it.

9. A motor vehicle (1) according to Claim 8, **characterized in that** at least two struts (4, 5) are connected by a support device that is movable with respect to the retaining bridge (12), in which a common control element is provided for simultaneous influencing of the struts (4, 5) connected to it.

10. A motor vehicle (1) according to one of the Claims 8 or 9, **characterized in that** the support device includes at least one arm designed as a balance beam, which can be pivoted in its middle area about an at least almost vertical axis with respect to the retaining bridge (12) and which is connected to the struts (4, 5) in its end areas.